

**BIODEGRADATION STUDY REPORT**

**The Aerobic Biodegradation of *N*-EtFOSE Alcohol by the Microbial Activity Present in  
Municipal Wastewater Treatment Sludge**

**Thursday, November 02, 2000**

**PROJECT NUMBER**

**PRINCIPAL ANALYTICAL INVESTIGATOR**

**CLIENT**

**CONTRACT LABORATORY**

**PROJECT DATES**

**AUTHOR**

**Report 2 of 2 for project CA058, Revised**

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Cleston C. Lange, Ph.D.,  
Pace Analytical Services, Science Solutions Division  
Wednesday November 1, 2000

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## List of Appendices

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## **Executive Summary**

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**1.0      Project Personnel**

**2.0      Data Requirements**

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**3.0      Project Objective**

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**4.0      Test Article**

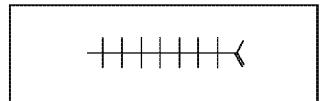
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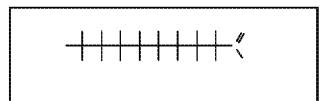
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**5.0      Control & Reference Articles**

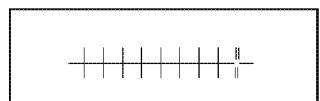
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**5.2.**



**5.3.**

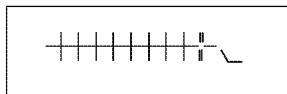


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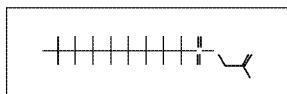


**5.5. N**

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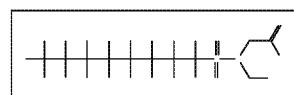


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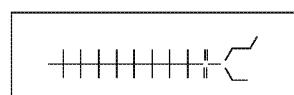
**5.7. N**

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**5.8. N**

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**6.0      Receipt/Generation of Samples**

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**7.0      Methods**

**Sample Preparation**

**7.1.1. Collection of Sludge.**

### **7.1.2. Culture Setup.**

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$\mu$                    $\mu$                    $N$   
                         $\mu$                    $\mu$                    $N$   
 $N$                    $\mu$                    $\mu$                    $\mu$

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$\mu$

$\mu$

### **7.1.3. Solid Phase Extraction of Cultures**

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## 7.2 Instrumental Analysis

$m/z$                      $m/z$                      $m/z$                      $m/z$   
 $m/z$              $N$                      $m/z$              $N$                      $m/z$

**Figure 15,**

$\mu$

**MSD Settings:**

**HPLC Settings:**

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### **7.3 Data Transformations and Calculations**

#### **7.3.1 Molar Calculations:**

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N

N

#### **7.3.2 Conversion of ng/mL to micromolar ( $\mu\text{M}$ ) and nanomolar (nM).**

**(Working Examples):**

$\mu$                    $\mu$

$\mu$                    $\mu$

### 7.3.3 Mass Balance Calculations:

$\mu$

$\mu$

(Working Example):

$N$

$\mu$

$\mu$

$\mu$

$N$

$\mu$

$N$

$\mu$

$\mu$

$\mu$

$\mu$

$\mu$

$\mu$

$\mu$

$\mu$

**91.7%**

## **7.4 Statistics**

### **7.4.1 Formula used for determination of Standard Deviation (SD):**

$$\frac{\sum \chi - \bar{\chi}}{\sqrt{\sum (\chi - \bar{\chi})^2}}$$

### **7.4.2 Formula used for Relative Standard Deviation (RSD):**

## **7.5 Software Versions**

TM

## **8.0 Results**

### **8.1 Incubator, Refrigerator, and Freezer Temperature Log Data.**

$27^{\circ}\text{C} \pm 1^{\circ}\text{C}$
$28^{\circ} \pm 2^{\circ}\text{C}$
$28^{\circ}\text{C} \pm 1^{\circ}\text{C}$
$-19^{\circ}\text{C} \pm 7^{\circ}\text{ C}$
$-77.0^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$
$4^{\circ}\text{C} \pm 2^{\circ}\text{C}$
$2.5^{\circ}\text{C} \pm 1.3^{\circ}\text{C}$

**8.2 Mishaps recorded during the Study.**

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### **8.3 Sludge Characterization Report**

#### **8.3.1 Metals:**

$\mu$   
 $\mu$

#### **8.3.2. Wet Chemistry:**

#### 8.4 Quality Control/Sample Matrix Spike Results.

Sample ID	Description	Recovery (%)							
		PFOA	PFOS	PFOSulfinate	M556	N-EtFOSAA	FOSA	N-EtFOSE-alcohol	N-EtFOSA

Table 1.

## **8.5 HPLC/MS Calibration and Calibration Verification.**

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$\mu$

$\mu$

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**8.6 Blanks**

**8.7 Matrix Spikes**

**8.8 Surrogate Spikes**

## 8.9 Sample Results

### 8.9.1 Results of incubations with 47 ng/mL of *N*-EtFOSE alcohol.

Appendix C

Table 4 Appendix D.

Table 1 Appendix B

Table 2

Table 3

Figure 1,

Figure 1

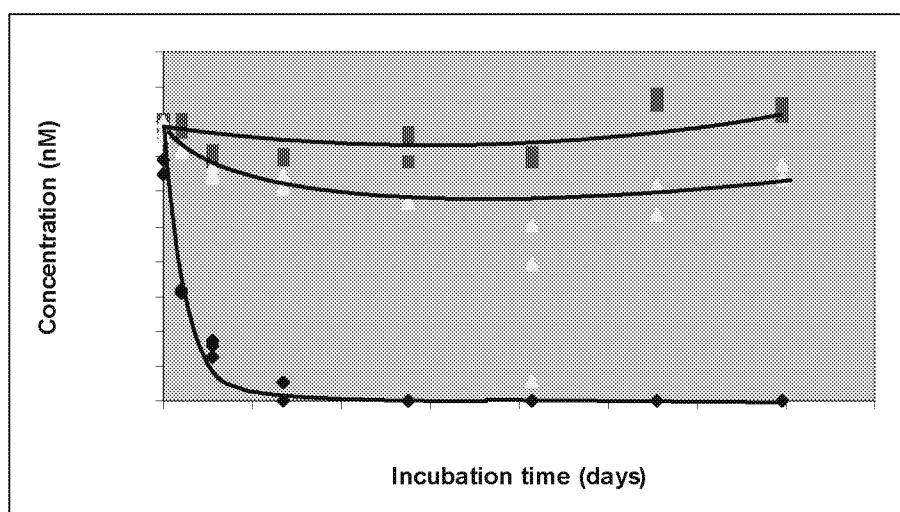
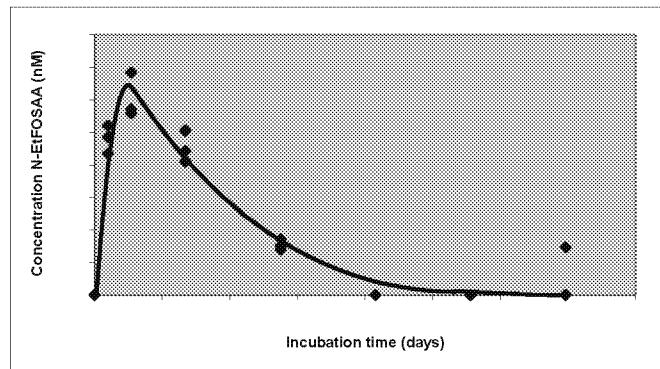
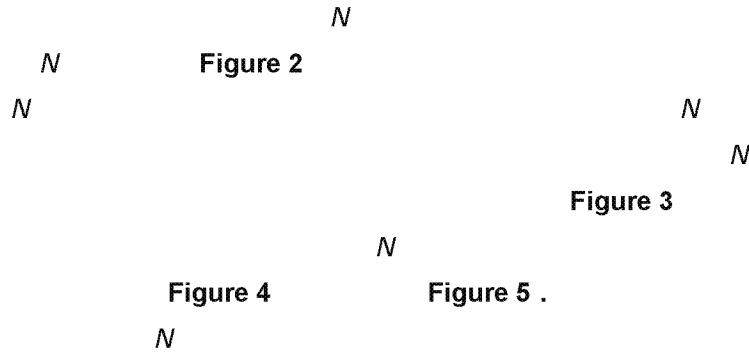


Figure 1.

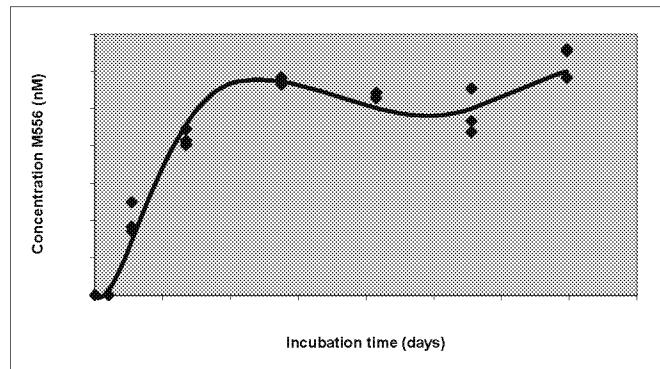
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**Figure 2.**

N

N



**Figure 3.**

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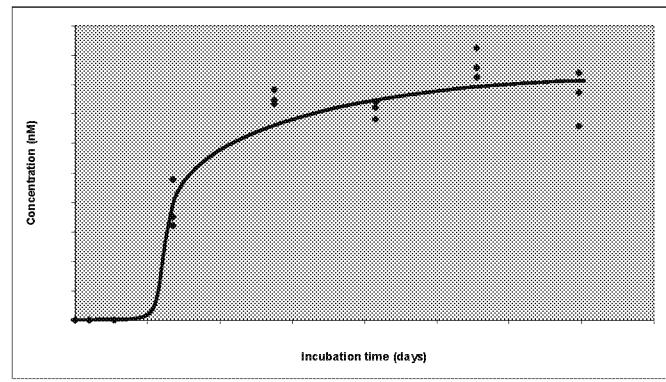


Figure 4.

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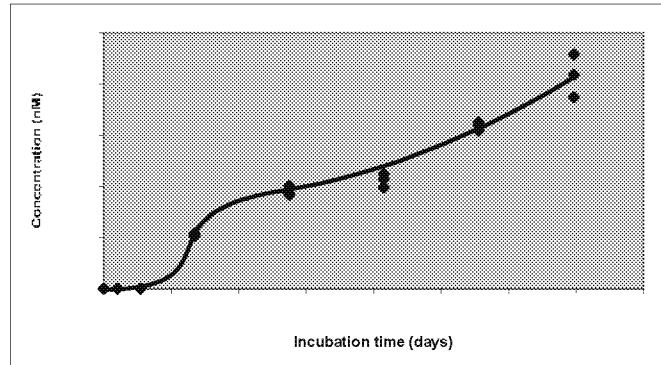


Figure5.

*N*

### 8.9.2 The Results of incubation with 2,380 ng/mL of *N*-EtFOSE alcohol.

Table 1 Appendix B

Table 1 Appendix C

Table 1      Table 2      Appendix D.

Figure 14

$\mu$     N

Figure 6

N

Figure 6

N

N

Figure 7

Appendix E, Table 1.

N

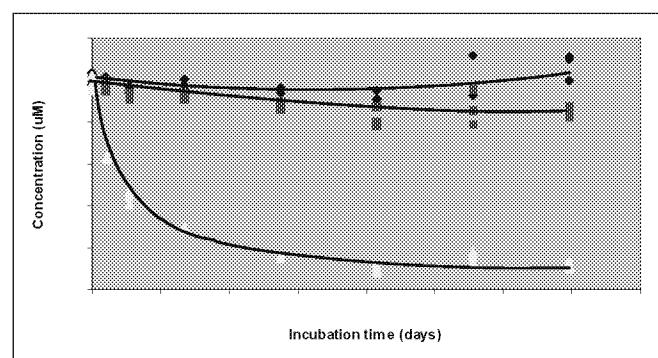


Figure 6.

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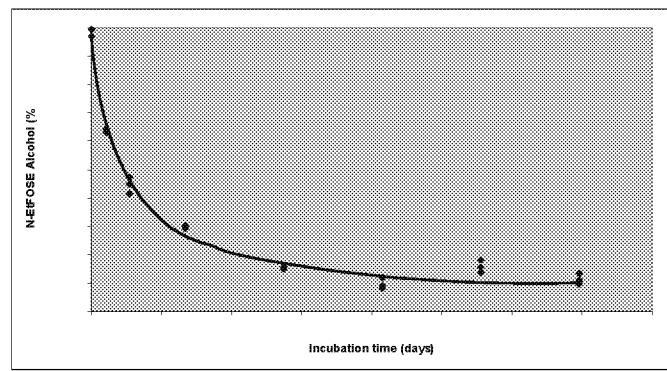


Figure 7.

N

$$\frac{\mu}{N} = \frac{\mu}{N}$$

N

Figure 1).

N

N

N

Figure 8

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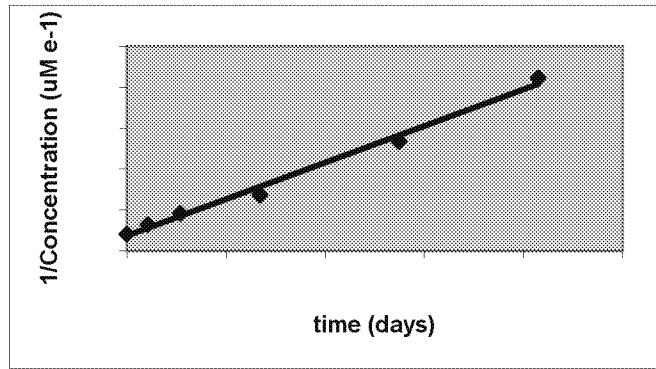


Figure 8.

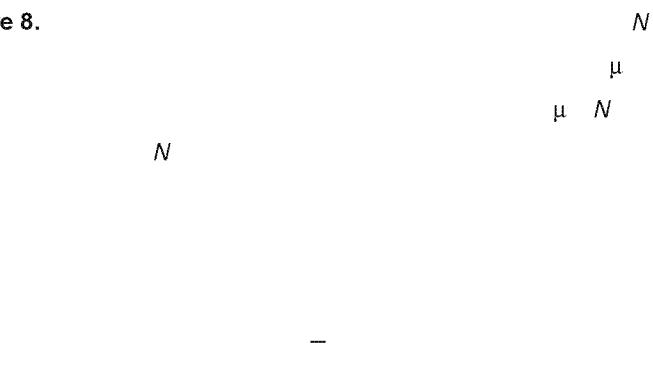


Table 1 Appendix F

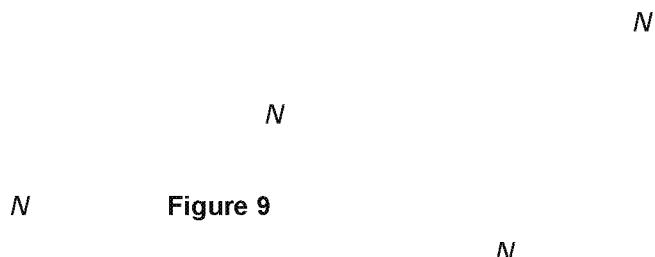


Figure 9

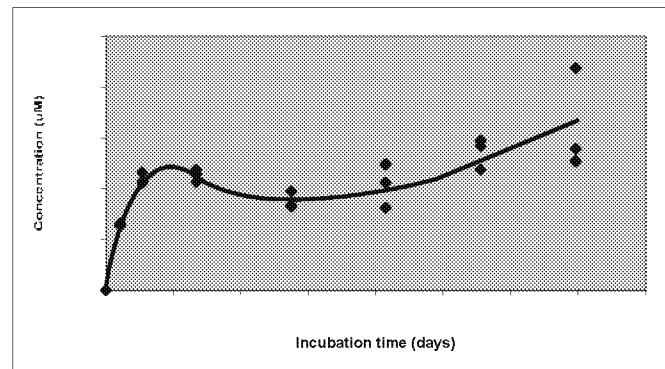


Figure 9.

$N$   
 $\mu$   $N$

Figure 10

$N$   
 $N$

$N$

$N$

$N$

Figure 15

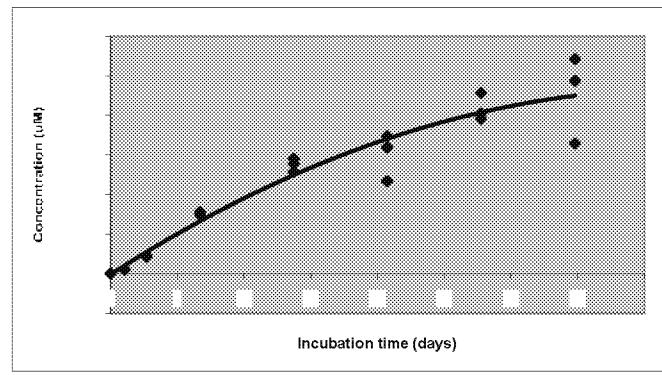


Figure 10.

$\mu = N$

Figure 11

Figure 12

$N$

$/N$

Figure 15

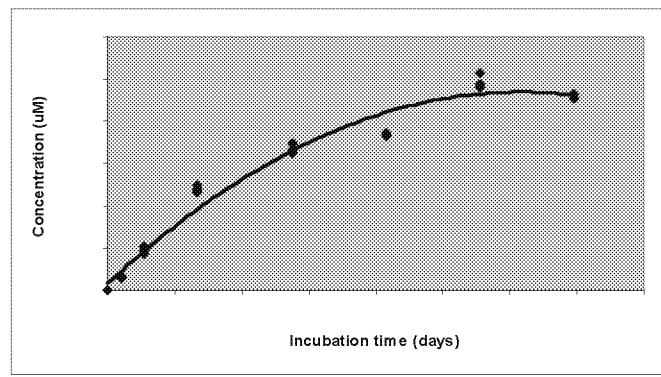


Figure 11.

$\mu = N$

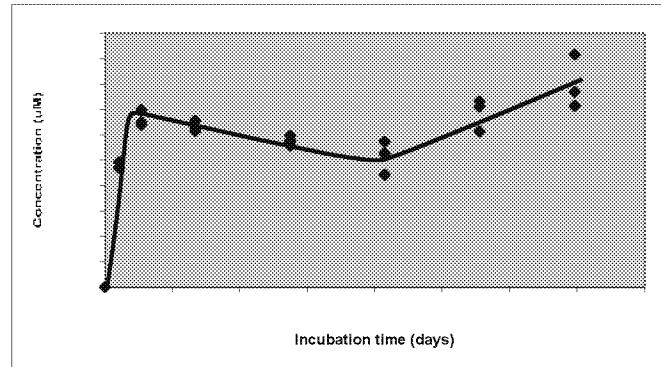


Figure 12.

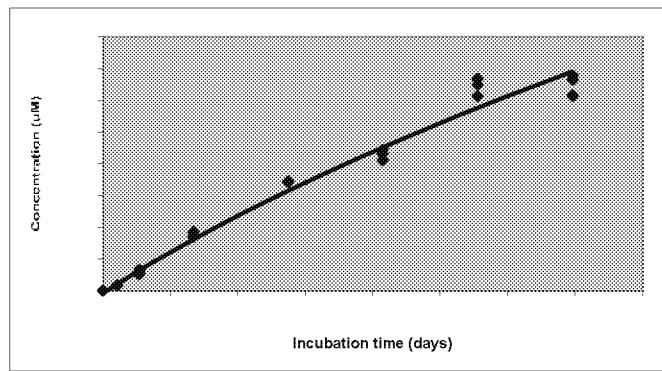
$\mu = N$

Figure 13

Figure 14

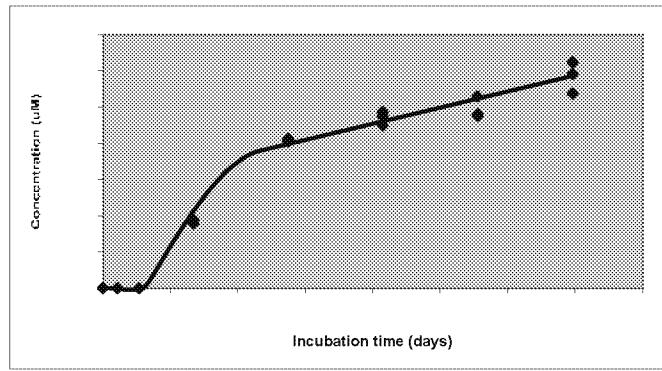
Hu et.al. 1990, *J. Fluorine*

*Chemistry*



**Figure 13.**

$\mu$   $N$



**Figure 14.**

$\mu$   $N$

## Conclusions

$N$

$N$

$\mu$

$\mu$

$N$

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*N*

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**Table 1, Appendix E**

**Figure 15**

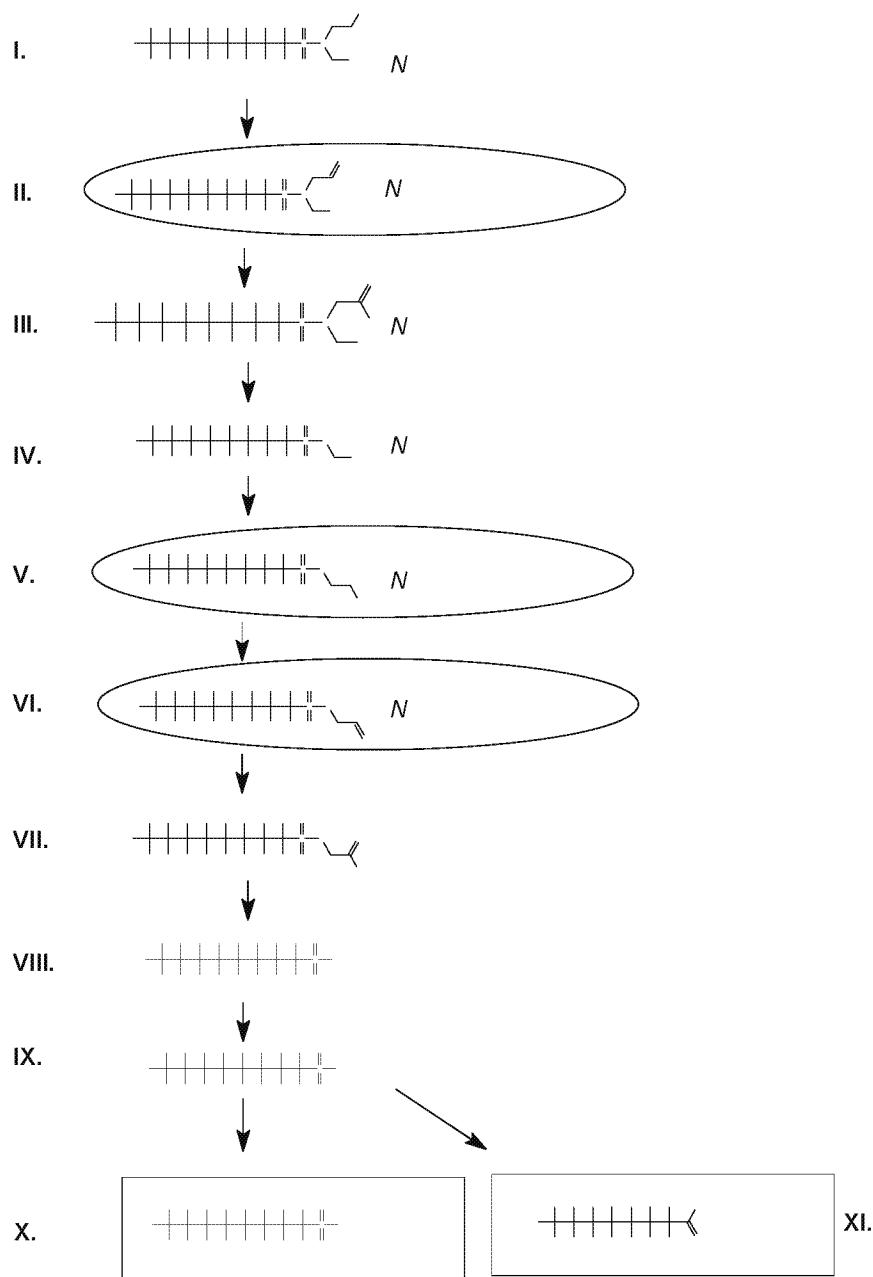
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*N*

**Figure 15**



**Figure 15.**

**10.0    Sample and Data Retention**

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▪  
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▪  
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**APPENDIX A**  
**SIGNATURES OF PROJECT PERSONNEL**

**Project Title:** N

**Client Project ID:**

**Contract Analytical Project Number:**

**The following individuals participated in the conduct of this project:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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**Appendix B, Table 2 continued.**

Description	Concentration ( $\mu\text{M}$ )						
	PFOA	PFOS	PFOS sulfinate	M556	N-EtFOSAA	FOSA	N-EtFOSE alcohol
Description	Concentration ( $\mu\text{M}$ )						
	PFOA	PFOS	PFOS sulfinate	M556	N-EtFOSAA	FOSA	N-EtFOSE alcohol
Description	Concentration ( $\mu\text{M}$ )						
	PFOA	PFOS	PFOS sulfinate	M556	N-EtFOSAA	FOSA	N-EtFOSE alcohol











## Appendix F

μ

Sampling	90 nM mass balance				Sampling	4.168 μM mass balance			
	Biodeg sample	Sterile controls	no-sludge controls	All samples		Biodeg sample	Sterile controls	no-sludge controls	All samples
Averages					Averages				
Std Devs					Std Devs				
RSD =					RSD =				

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**APPENDIX A**  
**SIGNATURES OF PROJECT PERSONNEL**

Project Title: 5-Week N-EtFOSE Alcohol Aerobic Biodegradation Study

Client Project ID: LIMS E00-2252

Contract Analytical Project Number: CA058

The following individuals participated in the conduct of this project:

Study Director:

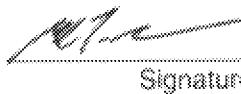
Cleston C. Lange

  
Signature

11/1/00  
Date

Laboratory Management:

Mark T. McCann

  
Signature

01 Nov 2000  
Date

Report Author:

Cleston C. Lange

  
Signature

11/1/00  
Date

Sample Preparation Analyst:

Angela L. Schuler

  
Signature

11/1/00  
Date

HPLC/MS Analysis Conducted by:

Anthony E. Scales

  
Signature

11/1/00  
Date

Final Report Reviewed by:

Dirk W. Hoogenboom

  
Signature

01 Nov 2000  
Date